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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The purpose of this study was to examine the long-term additive ambient impact of certa toxic air pollutants that will potentially be emitted from the Chemical Agent Incinerat (AI) proposed for the Edgewood Area (EA) of Aberdeen Proving Ground (APG), Maryland and from three additional planned or existing incinerators also located on the EA. This im was determined in consideration of the existance and operation of three additional plan or existing incinerators also located on EA. Based on air dispersion modeling conducte as part of an original analysis, emissions of chlorinated organics from the U.S. Army Medical Research Institute for Chemical Defense Pathological Waste Incinerator and the Chemical Research, Development and Engineering Center Decontamination/Detoxification Incinerator were found to have little or no ambient air quality impact, relative to the Municipal Waste Incinerator (MWI), for downwind distances as great as the distance to t nearest boundary of the EA. Consequently, for this evaluation, only the MWI is conside to emit chlorinated organics. (keywords)

See reverse side for continuation.

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22c. OFFICE SYMBOL: AMCPEO-CDE

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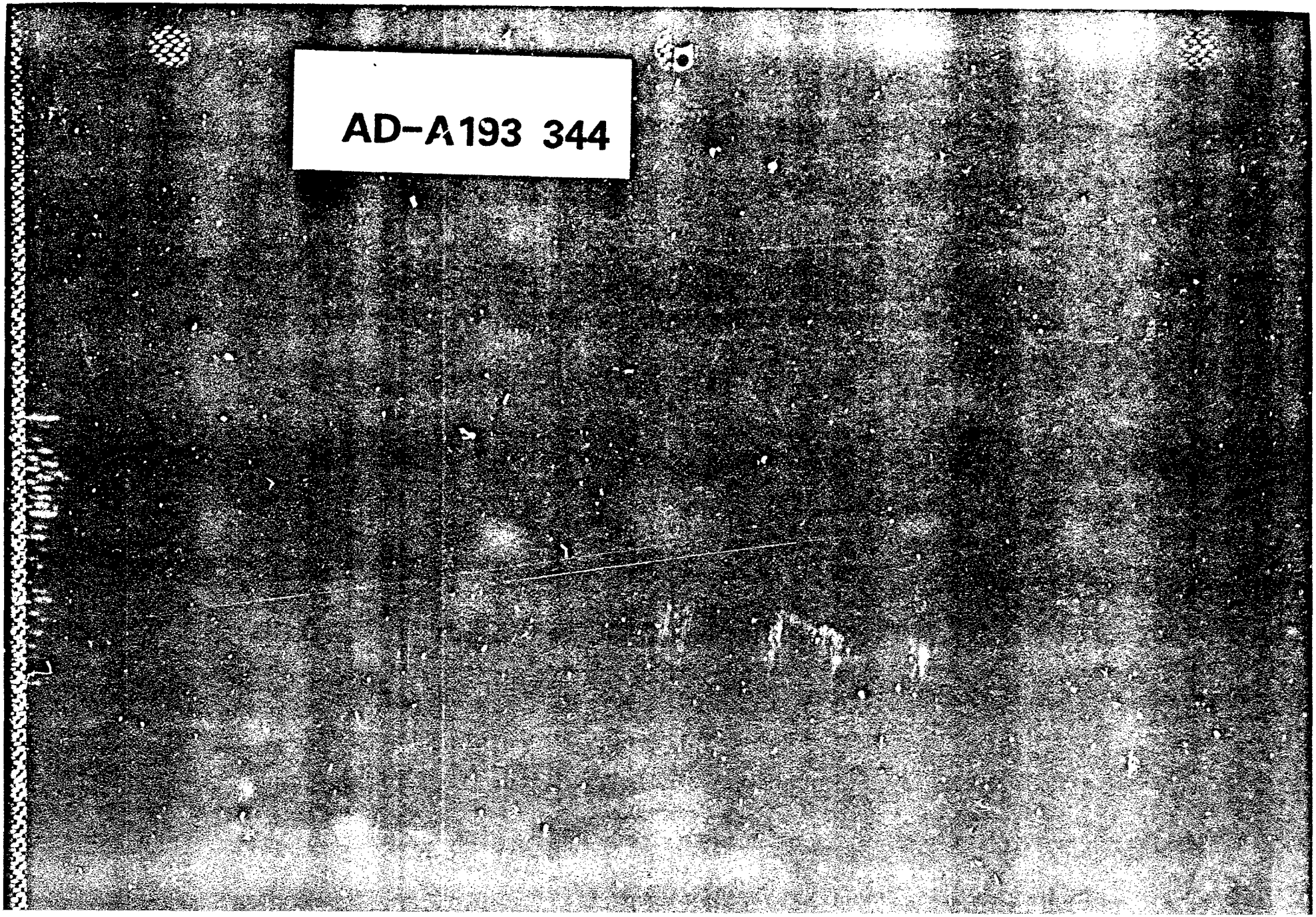
AD-A193 344

19. ABSTRACT Continuation:

Synergistic effects, due to the overlapping of air emissions plumes, were not considered because the composition of the effluent could not be defined in sufficient detail for this analysis and because synergisms between toxic substance are not well understood or quantifiable. Furthermore, the effluent plumes are rarely expected to overlap. Consequently, only the additive effects of chronic exposure to ambient concentrations of the selected pollutants were examined in this study.

Distribution Statement A is correct for this report.
Per Mr. Allan McKinney, Ofc of PEO-PM Chem Demil

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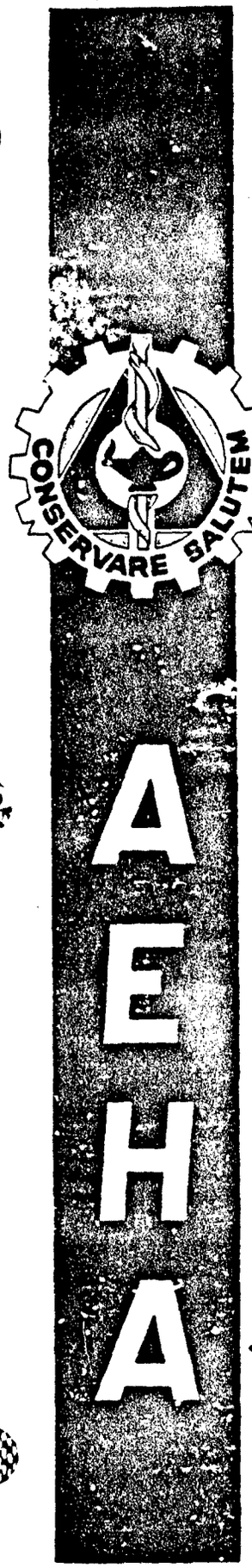

UNITED STATES ARMY ENVIRONMENTAL HYGIENE AGENCY

ABERDEEN PROVING GROUND, MD 21010-5422

AIR POLLUTION CONSULTATION
NO. 43-21-1229-87
EVALUATION OF MULTIPLE INCINERATOR AIR QUALITY IMPACTS
EDGEWOOD AREA
ABERDEEN PROVING GROUND, MARYLAND
MAY 1987

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DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

REPLY TO ATTENTION OF
HSHB-ME-AA

19 JUN 1987

MEMORANDUM FOR: Commander, U.S. Army Materiel Command, ATTN: AMCSG, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001

SUBJECT: Air Pollution Consultation No. 43-21-1229-87, Evaluation of Multiple Incinerator Air Quality Impacts, Edgewood Area, Aberdeen Proving Ground, Maryland, May 1987

EXECUTIVE SUMMARY

1. The purpose of this report was to examine the long-term additive impact of certain toxic air pollutants that have the potential to be emitted from the chemical agent incinerator proposed for the Edgewood Area of Aberdeen Proving Ground, Maryland and from three additional incinerators either existing or under construction on the Edgewood Area.

2. There are no recommendations at this time.

FOR THE COMMANDER:

Encl

KARL J. DAUBEL
Colonel, MS
Director, Environmental Quality

CF:
HQDA(DAEN-ZCF-U/DAEN-ZCE) (w/encl)
HQDA(DASG-PSP) (wo/encl)
Cdr, TECOM, ATTN: AMSTE-FE-M (w/encl)
Cdr, MEDDAC, Ft Meade, ATTN: PVNTMED Svc (w/encl)
Cdr, WRAMC, ATTN: PVNTMED Svc (2 cy) (w/encl)
Prog Mgr, Chem Demil, ATTN: AMCPM (w/encl)
Cdr, USAEHA Fld Spt Actv, Ft Meade (w/encl)
Cdr, USAMRICD (w/encl)
Cdr, CRDEC (w/encl)

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

REPLY TO ATTENTION OF
HSHB-ME-AA

AIR POLLUTION CONSULTATION NO. 43-21-1229-87
EVALUATION OF MULTIPLE INCINERATOR AIR QUALITY IMPACTS
EDGEWOOD AREA
ABERDEEN PROVING GROUND, MARYLAND
MAY 1987

1. AUTHORITY. Initial End, HQ AMC, AMCSG, 28 May 1987, to letter, Program Manager for Chemical Munitions (Demilitarization and Binary) (Provisional), AMCPM, 20 May 1987, subject: Request for Reevaluation of Multiple-Incinerator Stack Effects at APG, Based Upon Additional Data.

2. PURPOSE. The purpose of this study was to examine the long-term additive impact of certain toxic air pollutants that have the potential to be emitted from the chemical agent incinerator (AI) proposed for the Edgewood Area (EA) of Aberdeen Proving Ground (APG), Maryland and from three additional planned or existing incinerators also located on the EA.

3. BACKGROUND.

a. The ambient impacts of multiple incinerators operating on the EA were first examined by USA Environmental Hygiene Agency (USAEHA) in December 1986 (Appendix A, reference 3). A reevaluation was requested because revised emissions information for the AI has become available since the original evaluation was performed.

b. The original evaluation examined the impacts of emissions from three incinerators in addition to the AI, the Harford County Municipal Waste Incinerator (MWI) (currently under construction), the USA Medical Research Institute for Chemical Defense (USAMRICD) pathological waste incinerator (PWI), and the USA Chemical Research, Development, and Engineering Center (USACRDEC) decontamination/detoxification (DECON/DETOX) incinerator. The location of these incinerators are shown on the following Figure. The evaluation emphasized the impacts of certain toxic air pollutants commonly present in waste incinerator emissions for which ambient standards do not generally exist. These pollutants were defined to be a group of chlorinated organic compounds consisting of dioxins, furans, polychlorinated biphenyls (PCBs), chlorobenzenes, and chlorophenols. In addition, mustard (HD) emissions from the AI were considered.

c. The revised source emissions information consisted of new emission rates for HD and additional data on the products of incomplete HD combustion.

(1) For the original evaluation, AI emission rates for HD were taken from Appendix A, reference 9. The revised HD emission rates that were provided in the authority letter reflect revised hours of incinerator operation and changes in the building ventilation rate.

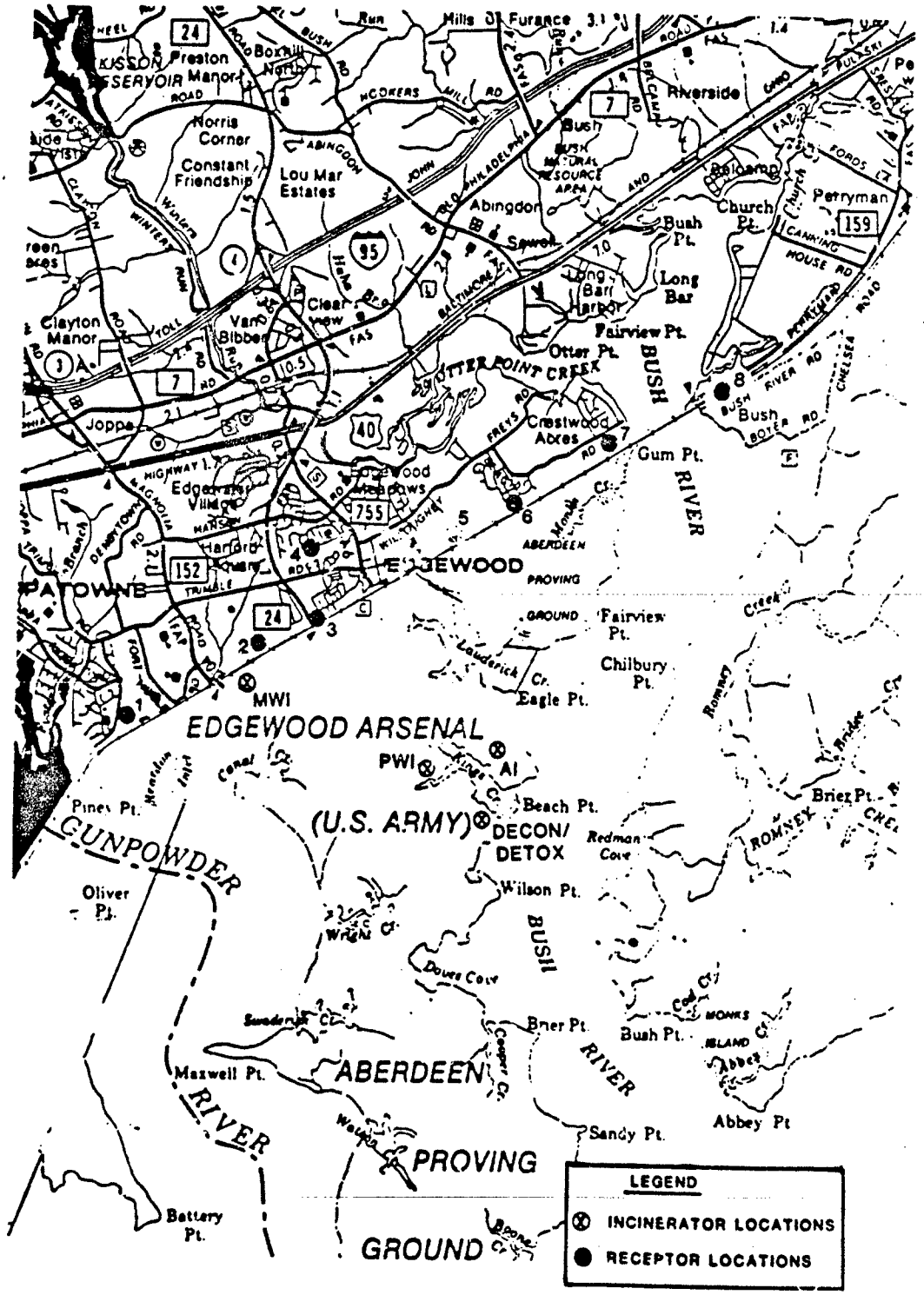

FIGURE. Location of APG-EA Incinerators

(2) Due to a lack of available data, the original evaluation conservatively assumed that chlorinated organics would be formed during HD incineration and would be emitted from the stack at a rate of one percent of the emission rate given for nonmethane hydrocarbons (Appendix A, reference 9). The incinerator designer has recently completed an analysis which indicates that, for HD incineration at design operating conditions, negligible amounts of chlorinated organics are formed as products of incomplete combustion. This information was provided informally by the Office of the Program Manager for Chemical Munitions.

d. Based on air dispersion modeling conducted as part of the original analysis, emissions of chlorinated organics from the PWI and the DECON/DETOX were found to have little or no ambient air quality impact, relative to the MWI, for downwind distances as great as the distance to the nearest boundary of the EA. Consequently, for this evaluation, only the MWI is considered to emit chlorinated organics.

e. A preliminary evaluation was conducted in which the frequency of occurrence of simultaneously overlapping plumes from the MWI and the AI was examined (Appendix A, reference 4). Significant plume overlap was estimated to occur 5 percent of the time or less, depending on the extent of plume overlap. In addition, local winds were believed to be sufficiently variable in direction that any overlap would persist no more than a few hours. Furthermore, dispersion modeling conducted for the original evaluation showed that areas having the greatest long-term ambient impact of emissions from the two facilities did not overlap.

f. Synergistic effects, due to overlapping plumes, were not considered because the composition of the effluent could not be defined in sufficient detail for such an analysis and because synergisms between toxic substances are not well understood or quantifiable. Furthermore, the effluent plumes are rarely expected to overlap. Consequently, only the additive effects of chronic exposure to ambient concentrations of the selected pollutants were examined in this study.

4. DISCUSSION OF METHODOLOGY.

a. Ambient Concentrations of HD. Dispersion modeling was used to calculate theoretical estimates of annual average ambient ground level concentrations of HD.

(1) The Industrial Source Complex (ISC) dispersion model was selected as appropriate for this application (Appendix A, reference 5). The U.S. Environmental Protection Agency (EPA) lists this model as a refined model preferred for regulatory applications (Appendix A, reference 6). The short-term version of the model (ISCST) was used. This version calculates concentrations sequentially using hourly meteorological data. The hourly concentrations are then averaged over the annual period. The modeling was conducted assuming that the surrounding terrain was flat and that local land use could be classified as rural. Effluent plume rise was calculated as a function of downwind distance using the generalized Briggs plume rise equations.

(2) For the original analysis, ambient concentrations were calculated at locations defined by a rectangular grid array. Based on the results of this modeling, eight receptors were selected as representative of the locations of the most significant offpost impacts from the incinerators of interest. The location of these receptors are shown in the Figure. Receptors 2 and 7 are the approximate locations of the maximum offpost impact from the MWI and the AI, respectively. The other six receptors are considered to be indicative of impacts to surrounding higher density population areas (e.g., Edgewood and Joppatowne).

(3) Source information used in modeling AI HD emissions are given in Table 1 (from the authority letter and Appendix A, reference 9). The HD feed was assumed to contain no contaminants. For modeling, continuous incinerator operation was assumed. The authority letter provided an emission rate from the liquid incinerator/metal parts furnace stack of 0.00020 gm/sec for an operating time of 2000 hours per year. Total annual emissions based on these data were used to determine an emission rate for the continuous operation (8760 hours per year) assumption. The ventilation system is expected to run continuously.

TABLE 1. EMISSIONS INFORMATION USED TO MODEL MUSTARD FROM THE AI

Source	Emission Rate (gm/sec)	Stack Characteristics Height(m)	Dia(m)	Stack Gas Characteristics Vel (m/sec)	Temp (K)
Liquid Inc/ Metal Parts Furnace	0.00005*	38	0.7	17	352
Demil Bldg Ventilation	0.00057	38	1.4	7	300

*Adjusted for continuous operation based on total annual emissions

(4) Hourly surface meteorological data used for the modeling were from Phillips Army Airfield, located at the Aberdeen Area of APG, for the period 1 January through 31 December 1955. Concurrent twice daily mixing height data were for Spring Hill, Maryland. Surface data suitable for dispersion modeling were not available for Aberdeen after 1957. However, meteorological data from this period are believed to be representative of the current dispersion climatology of the Aberdeen Area. An annual wind rose showing the frequency of occurrence of hours of selected wind speed and wind direction classes is shown in Appendix B. The 1955 data set was selected as reasonably representative of the local dispersion climatology based on a qualitative comparison of annual wind roses for each of the years 1953-1956 with a wind rose for the period 1947-1956.

b. Ambient Concentrations of Chlorinated Organics. Model estimated annual average ambient concentrations of chlorinated organics due to emissions from the MWI were taken from the original analysis. These concentrations were calculated using a methodology identical to that described in paragraph 5a(1), above. Meteorological data from APG for 1955 were also used. Emission rates for chlorinated organics were determined from the results of a study of a similar type incinerator (Appendix A, reference 8). Source information used in the modeling is given in Table 2. The emission rate is based on continuous operation at the maximum design feed rate (310 tons per day).

TABLE 2. EMISSIONS INFORMATION USED TO MODEL CHLORINATED ORGANICS FROM THE MWI

Emission Rate (gm/sec)	Physical Stack Characteristics		Stack Gas Characteristics	
	Height(m)	Diameter(m)	Velocity(m/sec)	Temp(K)
0.0011	18	1.4	20	472

c. Risk Calculations.

(1) The carcinogenicity of a substance may be indicated by in vitro tests, more strongly suggested by animal studies, or further documented by human epidemiological evidence. For some carcinogens, models have been developed that allow calculation of carcinogenic potency factors. Such factors allow quantitation of carcinogenic risk. Assuming low-dose linearity, the risk of cancer associated with a given pollutant concentration is estimated using the relationship:

$$\text{Risk} = Q^* \times D$$

where Risk is the additional lifetime risk of developing cancer based on a lifetime of constant exposure to a substance with a carcinogenic potency factor Q* at a particular dose, D (Appendix A, reference 7). The term Q* is expressed in milligram per kilogram per day (mg/kg/day)-1 and D is in (mg/kg/day). Risk estimates are determined assuming a 70-year lifetime for a 70 kg individual with a 20 cubic meter per day inhalation rate. Although no standard for an acceptable lifetime cancer risk exists, risks of 10^{-6} are considered adequately protective by the EPA (Appendix A, reference 10).

(2) For this analysis, the additive carcinogenic effects associated with exposure to all of the chlorinated organics that are emitted from the MWI were assumed to be equivalent to that of PCBs. The human carcinogenic potential of PCBs is not known, particularly for the inhalation route of exposure. A Q* value developed from ingestion studies using laboratory animals was used to calculate the risk estimates. This Q* value is 4.34 (mg/kg/day)-1 (Appendix A, reference 7).

Not all of the chlorinated organic emissions are considered carcinogenic and those that are considered carcinogenic have a wide range of potencies. For example, a form of dioxin, 2,3,7,8 tetrachlorodiphenyl dioxin (TCDD), is known to be considerably more toxic to some animals than PCBs. However, emissions of 2,3,7,8 TCDD will comprise a minute portion of the total emission of chlorinated organics. No formal Q* has been developed for HD by EPA or any other regulatory agency.

5. FINDINGS AND DISCUSSION.

a. Ambient Pollutant Concentrations.

(1) Model estimated annual average ground level concentrations of HD at the receptor locations are given in Table 3. No depletion of the HD through atmospheric chemistry processes was assumed to occur. Emission rates given in Table 1 are based on an in-stack concentration standard of 0.03 milligram (mg)/m^3. Actual stack concentrations likely will be much lower. Consequently, the modeled concentrations given in Table 3 are believed to be conservative (overestimated). As indicated in the authority letter, the means for a lower minimum detection sensitivity for in-stack monitors is being investigated. If better sensitivities are achieved, a stack standard as low as 0.003 mg/m^3 may be established. For such a standard, ambient HD concentrations shown in Table 3 would be less by a factor of ten.

TABLE 3. ESTIMATED ANNUAL CONCENTRATIONS OF HD AT SELECTED RECEPTOR SITES

Receptor	Concentration (Nanograms/m^3)
1	0.013
2	0.021
3	0.023
4	0.026
5	0.033
6	0.018
7	0.037
8	0.026

(2) Model estimated annual average ground level concentrations of chlorinated organics at the eight receptor locations are given in Table 4. As summarized previously, the MWI was assumed to be the only emitter of chlorinated organics. Since the MWI likely will not operate continuously at full capacity, these concentrations should be considered conservative.

TABLE 4. ESTIMATED ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS OF CHLORINATED ORGANICS AT SELECTED RECEPTOR LOCATIONS

Receptor	Concentration (Nanograms/m^3)
1	0.100
2	0.328*
3	0.149
4	0.102
5	0.057
6	0.044
7	0.024
8	0.026

* Approximate location of maximum impact

b. Excess Lifetime Cancer Risks.

(1) Estimated excess cancer risk due to lifetime exposure to modeled concentrations of chlorinated organics emitted from the MWI were calculated for each receptor. These estimated risks are listed in Table 5. Because of the conservative assumptions used in the modeling (e.g., continuous operation), these risks are believed to be overestimates of actual risks.

TABLE 5. ESTIMATED EXCESS LIFETIME CANCER RISKS DUE TO EXPOSURE TO MODELED CONCENTRATIONS OF CHLORINATED ORGANICS

Receptor	Risk
1	1×10^{-7}
2	4×10^{-7}
3	1×10^{-7}
4	2×10^{-7}
5	7×10^{-8}
6	5×10^{-8}
7	3×10^{-8}
8	3×10^{-8}

(2) Because no formal carcinogenic potency factor has been developed for HD, quantitative cancer risks could not be calculated. However, based on the best available scientific data, the estimated ambient levels of exposure to HD given in Table 3 are believed to pose negligible excess lifetime cancer risk.

6. SUMMARY AND CONCLUSIONS.

a. The results of dispersion modeling indicate that offpost areas receiving the greatest long-term impact of emissions from the AI and the MWI, respectively do not overlap. This result is consistent with the conclusions of a preliminary analysis regarding simultaneous plume overlap.

b. For emissions of chlorinated organic compounds from the MWI, conservative estimated excess lifetime cancer risks at eight locations outside of the EA bounc range from 4×10^{-7} to 3×10^{-8}. For comparison, risks of 1×10^{-6} are considere to be appropriately protective by EPA and most individuals.

c. Lifetime exposure to model estimated ambient levels of HD are believed to be sufficiently low to pose negligible lifetime cancer risks with respect to risks considered adequately protective. In addition, the AI is expected to opera 2 years rather than a 70 year lifetime.

7. RECOMMENDATIONS. There are no recommendations at this time.

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Occupational and Environmental Medicine Division

APPROVED:

for LESTER Y. PILCHER
MAJ, MS
Chief, Air Pollution Engineering Division

APPENDIX A

REFERENCES

1. AR 40-5, 30 August 1986, Preventive Medicine.

2. AR 200-1, 15 June 1982, Environmental Protection and Enhancement.

3. Letter, USAEHA, HSHB-ME-AA, 4 February 1987, subject: Air Pollution Consultation No. 43-21-1229-87, Evaluation of Multiple Incinerator Air Quality Impacts, Edgewood Area, Aberdeen Proving Ground, Maryland, December 1986.

4. Letter, USAEHA, HSHB-ME-AA, 10 October 1986, subject: Air Pollution Consultation No. 43-21-1229-87, Evaluation of Multiple Incinerator Stack Effects at Edgewood Area, Aberdeen Proving Ground - Preliminary Analysis of Overlapping Plumes.

5. Environmental Protection Agency Report No. EPA-450/4-79-030, December 1979, Industrial Source Complex (ISC) User's Guide, Volumes I and II.

6. EPA Report No. EPA-450/2-78-027R, July 1986, Guideline on Air Quality Models (Revised).

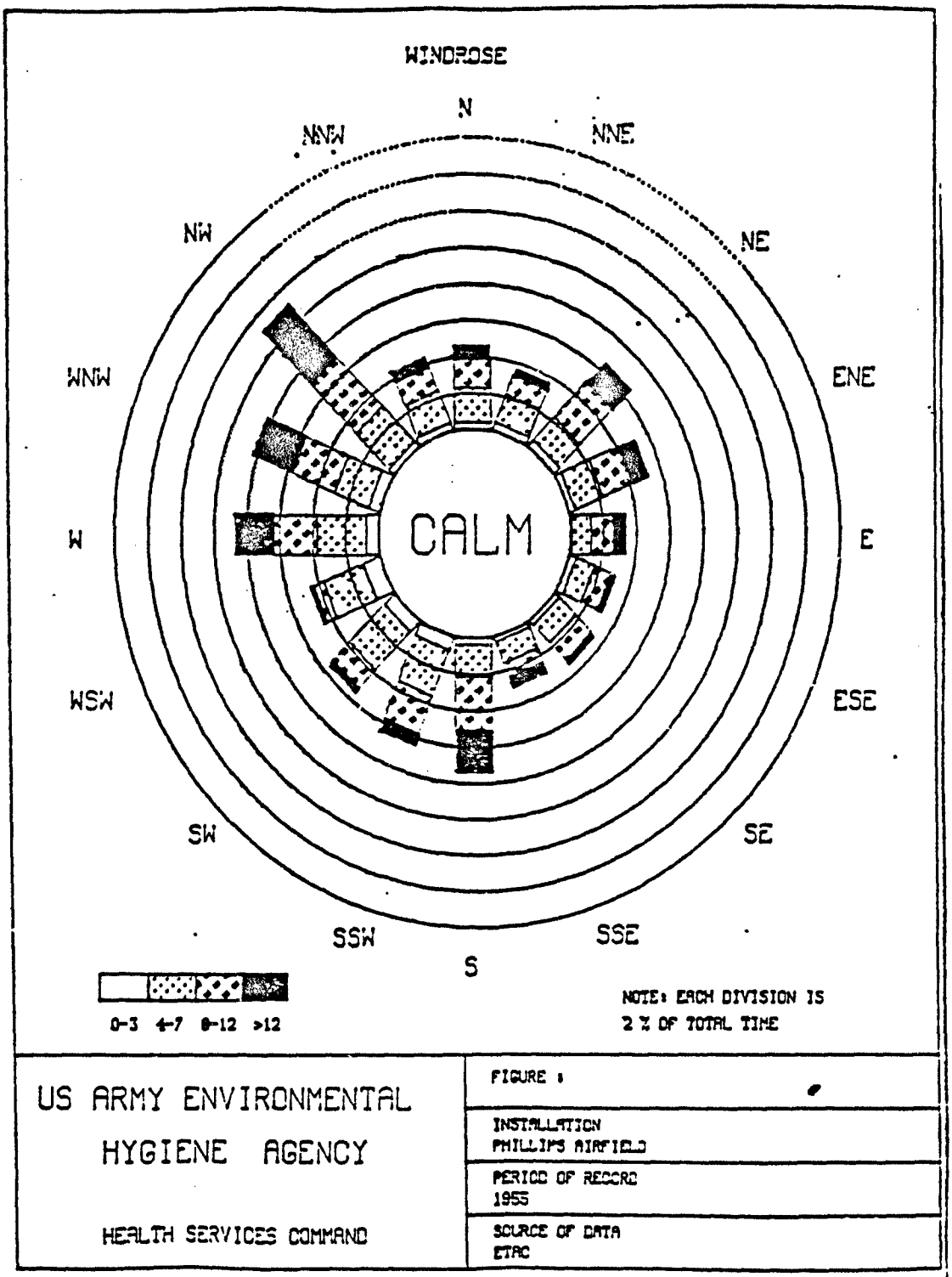
7. EPA Report No. DHEA-E-187, May 1986, Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup.

8. V. Ovacic; G. Wong; H. Tosine; R.E. Clement; and J. Osborne, "Emissions of Chlorinated Organics from Two Municipal Incinerators in Ontario," Journal of the Air Pollution Control Association, Volume 35, No. 8, August 1985.

9. Permit to Construct for the Department of Army Aberdeen Proving Ground Chemical Stockpile Disposal System, Revision 0, Program Manager for Chemical Munitions (Demilitarization and Binary) (Provisional), AMCPM, 30 September 1986.

10. Proposed Rule, National Primary Drinking Water Regulations; Synthetic Organic Chemicals, Inorganic Chemicals, and Microorganisms, 50 FR 46949, 13 November 19

APPENDIX B



US ARMY ENVIRONMENTAL HYGIENE AGENCY HEALTH SERVICES COMMAND	FIGURE 1
	INSTALLATION PHILLIPS AIRFIELD
	PERIOD OF RECORD 1955
	SOURCE OF DATA ETAC

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